| L Number | Hits | Search Text | DB | Time stamp |
|---|---|---|---|---|
| 1 | 237 | (active near2 matrix) with (light near2 emitting near2 diode) | USPAT; US-PGPUB | 2004/08/26 13:19 |
| 2 | 127 | ((active near2 matrix) with (light near2 emitting near2 diode)) and source and drain | USPAT; US-PGPUB | 2004/08/26 13:20 |
| 3 | 68 | (((active near2 matrix) with (light near2 emitting near2 diode)) and source and drain) and @ad<20020711 | USPAT; US-PGPUB | 2004/08/26 13:19 |
| 4 | 115 | (active near2 matrix) with (light near2 emitting near2 diode) | EPO; JPO; DERWENT; IBM_TDB | 2004/08/26 12:59 |
| 5 | 14 | ((active near2 matrix) with (light near2 emitting near2 diode)) and source and drain | EPO; JPO; DERWENT; IBM_TDB | 2004/08/26 12:59 |
| 6 | 3 | (("6365916") or ("5910829") or ("5402141")).PN. | USPAT; US-PGPUB | 2004/08/26 13:15 |
| 7 | 180 | (LG adj philips) and (active near2 matrix) | USPAT; US-PGPUB | 2004/08/26 13:19 |
| 8 | 132 | ((LG adj philips) and (active near2 matrix) ) and @ad<20020711 | USPAT; US-PGPUB | 2004/08/26 13:20 |
| 9 | 132 | (((LG adj philips) and (active near2 matrix) ) and @ad<20020711) not ((((active near2 matrix) with (light near2 emitting near2 diode)) and source and drain) and @ad<20020711) | USPAT; US-PGPUB | 2004/08/26 13:20 |
| 10 | 100 | ((((LG adj philips) and (active near2 matrix) ) and @ad<20020711) not ((((active near2 matrix) with (light near2 emitting near2 diode)) and source and drain) and @ad<20020711)) and source and drain | USPAT; US-PGPUB | 2004/08/26 13:20 |

US-PAT-NO: 6515428

DOCUMENT-IDENTIFIER: US 6515428 B1

TITLE: Pixel structure an organic light-emitting diode display device and its manufacturing method

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Brief Summary Text - BSTX (2):
The present invention relates generally to a pixel structure of an organic **light -emitting diode** (OLED) display device and its manufacturing method, and more particularly to a pixel structure of an **active matrix** full-color OLED display device and its manufacturing method.

Brief Summary Text - BSTX (6):
U.S. Pat. No. 5,550,066 discloses a process for making a pixel structure of a thin-film-transistor organic electroluminescent display device. FIG. 1a and FIG. 1b show respectively a diagrammatic plan view and a cross-sectional view of this conventional TFT-OEL device. As shown in FIG. 1a, the pixel structure of a TFT-OEL device 100 comprises mainly two thin film transistors 101 and 102, a storage capacitor 103, and a light emitting OEL pad 104 arranged on a substrate. The TFT 101 is the switching transistor with the **source** bus 105 as the data line and the gate bus 106 as the gate line. The ground bus 107 is located above the gate bus 106 and below the storage capacitor 103. The **source** electrode of the TFT 101 is electrically connected to a **source** bus and the gate electrode comprises a portion of a gate bus. The OEL pad 104 is electrically connected to the **drain** of the TFT 102. The

**drain** of the TFT 101
is electrically connected to the gate electrode of the TFT 102, which in turn
is electrically connected to the storage capacitor 103. The TFT-OEL devices
are typically pixel units that are formed into a flat panel display.

Brief Summary Text - BSTX (7):

FIG. 1b is a cross-sectional view, illustrating the process of forming a
pixel structure of this conventional TFT-OEL device. As shown in FIG. 1b, a
polysilicon layer is deposited over a transparent and insulating substrate 111
and the polysilicon layer is patterned into a polysilicon island 118. Next, a
first insulating gate layer 112 is deposited over the polysilicon island 118
and over the surface of the insulating substrate 111. A layer of silicon 114
is deposited over the gate insulator layer 112 and patterned by
photolithography over the polysilicon island 118, such that, after ion
implantation **source and drain** regions are formed in the polysilicon island 118.
Ion implantation is conducted with N-type dopants. A gate bus 116 is applied
and patterned on the insulating gate layer 112, and then a second insulating
layer 113 is applied over the entire surface of the device. Contact holes are
cut in the second insulating layer 113 and electrode materials are applied to
form contacts with the thin-film-transistors. The electrode material attached
to the **source** region of TFT 102 also forms the top electrode 122 of the storage
capacitor 103. A **source** bus and a ground bus are also formed over the second
insulating layer 113. In contact with the **drain** region of TFT 102 is the anode
136 for the OEL material. Then, an insulating passivation layer 124 is
deposited over the surface of the device. The passivation layer 124 is etched

leaving a tapered edge. The OEL layer 132 is then deposited over the passivation layer 124 and the anode layer 136. Finally, a cathode electrode layer 134 is deposited over the surface of the device.

Detailed Description Text - DETX (2):

FIG. 2 is a diagrammatic plan view of an active matrix OLED display device of full color according to the invention. Every pixel structure 200 of the active matrix OLED display device of full color comprises mainly two thin film transistors T.sub.1 and T.sub.2, a storage capacitor C.sub.s, a color filter 212, an OLED device structure 218 constructed on the top surface 214 of a substrate 210, and a black matrix region 220 outside the color filter region 212 and under the thin film transistor T.sub.2. Both thin film transistors T.sub.1 and T.sub.2 comprise respectively a **source** electrode, a **drain** electrode and a gate electrode. The gate electrode of the TFT T.sub.1 comprises a portion of a gate line. The **source** electrode of the TFT T.sub.1 is electrically connected to a data line and the **drain** electrode is electrically connected to the gate electrode of the TFT T.sub.2. The gate electrode of the TFT T.sub.2 is electrically connected to the storage capacitor C.sub.s. The OLED device structure 218 is electrically connected to the **drain** electrode of the TFT T.sub.2. Referring to FIG. 2, the TFT T.sub.2 is connected in series with the OLED device structure 218 and the TFT T.sub.1 is connected in series with the storage capacitor C.sub.s. The OLED device structure 218 is connected to the top surface 214 of an insulating substrate 210, such as a glass substrate. The black matrix region 220 is deposited over the top surface 214 of the insulating substrate. The TFT T.sub.1 is the switching transistor with

the data busline 205 as the data line, the gate busline 206 as the gate line
and V.sub.dd bus 207 as the power supply bus.

Detailed Description Text - DETX (8):
FIG. 6 is a cross-sectional view taken along the line B-B' in FIG. 2
illustrating the island process. In this process, a poly-si layer 606 is
deposited over the buffer layer 502 to define **source and drain** electrode
regions of the TFT T.sub.1 and define **source and drain** electrode regions of the
TFT T.sub.2. FIG. 6 shows only the **source** electrode region 604 and the **drain**
electrode region 602 of the TFT T.sub.2. Then, a polycrystalline silicon
island is formed and defined by laser crystallization and etching method, as
shown in FIG. 6.

Detailed Description Text - DETX (9):
In the embodiment of the present invention, the **source and drain** electrode
regions of the TFT T.sub.1 are formed after ion implantation and are conducted
with N+type dopants over the electrodes. The **source and drain** electrode
regions of the TFT T.sub.2 are conducted with P+type dopants over the
electrodes.

Detailed Description Text - DETX (11):
FIG. 8 is a cross-sectional view taken along the line B-B' in FIG. 2
illustrating the interlayer process of the full-color OLED display device
according to the invention. In this process, an interlayer 802 is deposited
over the gate layer and the polycrystalline silicon island. Then, two contact
holes 904 and 906 are made and a metal layer 902 is covered over the interlayer
802. The **source and drain** electrodes are deposited by definition. The result

is shown in FIG. 9.

Detailed Description Text - DETX (12):
Then, a passivation layer 1002 is covered on the metal layer 902, as shown in FIG. 10. The passivation layer 1002 may be made of photosensitive resin material or non-photosensitive resin material. A portion of the passivation layer 1002, the region of the color filter 212 and the **drain** electrode of the thin film transistor T.sub.2, are etched after exposure and development using a photo mask pattern by a standard photolithography process. Then, a layer of color filter made of photosensitive resin type is coated on the interlayer 802 by a standard photolithography process to define a color filter 212. The result is shown in FIG. 11. After this step, a transparent layer 1202, such as indium-tin-oxide (ITO), is deposited over the passivation layer 1002, the color filter 212 and the whole surface of the device. The transparent layer is defined as an anode layer and is electrically connected to the **drain** electrode of the thin film transistor T.sub.2. The result is shown in FIG. 12.

Detailed Description Text - DETX (14):
FIG. 14 is a cross-sectional view taken along the line A-A' in FIG. 2, where numeral 1402 represents an N+type doping polysilicon region. The polysilicon regions on the left-hand and right-hand sides of poly-si layer 606 are used as the **drain** electrode and the **source** electrode regions, respectively.

Claims Text - CLTX (1):
1. A pixel structure of an organic light-emitting diode (OLED) display device comprising: a substrate having top and bottom surfaces; a first thin

film transistor having a **source** electrode, a **drain** electrode and a gate
electrode, said **source** electrode of said first thin film transistor being
electrically connected to a data line, and said gate electrode comprising a
portion of a gate line; a second thin film transistor having a **source**
electrode, a **drain** electrode and a gate electrode, said gate electrode of said
second thin film transistor being electrically connected to said **drain**
electrode of said first thin film transistor; a storage capacitor, said
storage capacitor being connected in series with said first thin film
transistor and being electrically connected to said gate electrode of said
second thin film transistor; a color filter being formed in the pixel region
of said display device; a black matrix region being deposited under said
second thin film transistor and outside said color filter region to reduce the
leakage of light and increase the contrast of said display device; and an OLED
device structure comprising an anode electrode layer and a cathode metal layer
and being constructed on the top surface of said substrate, said anode
electrode of said OLED device structure being electrically connected to said
**drain** electrode of said second thin film transistor and being connected in
series with said second thin film transistor, via said color filter to get red,
green and blue colors of light to form said OLED device of full color; wherein
said black matrix region are deposited over the top surface of said substrate,
said first and second thin film transistors, said storage capacitor and said
color filter are all formed above said black matrix region and below said OLED
device structure.